(54) Title: METHOD AND SYSTEM FOR IDENTIFICATION OF CHANGES IN FLUIDS

(57) Abstract: Method and system for identification of a changed state of a fluid with respect to a reference state of the same
fluid, the fluid having an optical parameter changing with the change of the state of the fluid. The method comprises: a) providing
an optical arrangement including a transparent enclosure with a portion of the fluid, and an object observable through the optical
arrangement, the arrangement being designed such that an image of the object in the changed state of the fluid is optically distinctive
from an image of the object in the reference state of the fluid due to change of the optical parameter, at least one of the images
being predetermined; b) illuminating the object with diffuse light; c) observing a current image of the object through the optical
arrangement along an optical axis; and d) comparing the current image to the predetermined image to identify the changed state of
the fluid. The comparison and the identification may be performed by eye or by a sensor with a logical circuit.

METHOD AND SYSTEM FOR IDENTIFICATION
OF CHANGES IN FLUIDS

5   **FIELD OF THE INVENTION**

This invention relates to the examination of fluids based on their optical properties.

BACKGROUND OF THE INVENTION

There exist systems for measuring optical properties of fluids. US 4,569,590

10   to Karney describes a system for determining unknown index of refraction of a sample fluid with reference to the refraction index of a known reference fluid. The system comprises a collimated light source, a light pervious cell formed as a biconvex lens fillable with a fluid, a pair of gratings and a screen. Collimated light is directed through the cell filled first with the reference fluid and then with the

15   sample fluid, onto the gratings, and reference and sample patterns are obtained thereby on the screen. The sample pattern will be different from the reference one if the optical power of the biconvex lens changes due to the change of the liquid in the cell. The difference between the reference pattern and the sample pattern is then measured and used for calculating the refraction index of the sample fluid.

20   EP 1324015 describes similar techniques for measuring optical parameters of a phase object based on recording a moiré pattern viewed through the phase object. The moiré pattern is formed by illuminating two gratings by diffuse light, and projecting their images on a screen through the phase object. The optical parameters of the phase object are calculated from the moiré pattern.

25   Such methods require relatively complex optical systems, recording and measurement of images and sophisticated calculations in order to determine accurately a change in the optical parameter of the liquid.

SUMMARY OF THE INVENTION

The present invention makes use of the idea that small changes in optical properties of some fluids may be indicative of expected or unwanted changes in their composition, temperature and other non-optical properties. Thus, changes both of optical and non-optical properties may be monitored and detected by means of optical observations. In the following, terms like "optical" or "light" will refer to visible, ultraviolet and infrared light; words like "detect", "observe", "identify", "view" will refer both to human eye and to sensors. The term "change" will pertain, *inter alia*, to change of phase such as freezing, evaporation, etc; to change of structure such as setting, coagulation, etc; to evacuation, loss of vacuum, pressurization or depressurization.

In accordance with the present invention, there is provided a method for identification of a changed state of a fluid with respect to a reference state of the same fluid, the fluid having an optical parameter changing with the change of the state of the fluid, the method comprising:

a) providing an optical arrangement including a transparent enclosure with a portion of the fluid, and an object observable through the optical arrangement, the arrangement being designed such that an image of the object in the changed state of the fluid (changed image) is optically distinctive from an image of the object in the reference state of the fluid (reference image) due to change of the optical parameter, at least one of the images being predetermined (known);

b) illuminating the object with diffuse light;

c) observing a current image of the object through the optical arrangement along an optical axis; and

d) comparing the current image to the predetermined image to identify the changed state of the fluid.

The comparison and the identification in step (d) may be performed by eye or by a sensor with a logical circuit.

The diffuse light may be visible or in the UV or IR spectrum. In the latter case, the optical arrangement may include converter to visible light.

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The predetermined image may be known to a human observer from previous experience or verbal description, or may be depicted or described on or close to the optical arrangement. Alternatively, the predetermined image may be recorded in the optical arrangement and be made visible therein simultaneously with the current image, e.g. superimposed thereon for easier comparison.

Such optical parameter may be any parameter that would provide detectable difference in the images of the observed object as, for example, the refraction index of the fluid in reference and changed states of the fluid, but may be also the angle of polarization, or the index of absorption, the absorption spectrum, the reflection spectrum, etc. Changes in the structure of the fluid can also be detected, such as due to turbidity, setting, phase change, etc.

According to a second aspect of the present invention, there is provided an optical arrangement for identification of a changed state of a fluid with respect to a reference state of the fluid, the fluid having an optical parameter changing with the change of the state of the fluid, such as, for example, the refraction index of the fluid. The optical arrangement comprises:

a) a transparent enclosure adapted to be filled with at least a portion of the fluid;

b) an object observable through the enclosure,

c) an optical system having an optical axis and enabling the observation of the object when illuminated by diffuse light, via the enclosure filled with said fluid.

The optical arrangement is designed such that an image of the object observed in the changed state of the fluid is optically distinctive from an image of the object observed in the reference state of the fluid, due to a change of the optical parameter. At least one of the reference image and the changed image is predetermined, so that the identification can be done by comparing a current image of the object to the predetermined image.

The optical arrangement may comprise a source of diffuse light. The light may be in the UV or IR. spectrum, and the arrangement may comprise also a converter to visible light. Alternatively, the ambient light may be used.

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The optical system may be adapted to form the current image on the retina of the eye. Alternatively, the optical system may be adapted to form the current image on a screen. The image may also be viewed via a video camera. In the latter two cases, the optical system comprises a small aperture in front of the eye, the screen or in the video camera.

The optical arrangement may comprise a sensor with logical circuit adapted to perform the identification instead of the human eye.

Preferably, the transparent enclosure, when filled with the fluid in one of the states (the changed state or the reference state), constitutes a lens or a prism with zero power, while when filled with the fluid in the other state, it constitutes a lens or prism with non-zero power. However, working arrangement may be obtained also when the transparent enclosure constitutes a lens or a prism with non-zero but different power in both states of the fluid. The transparent enclosure is preferably located between the object and the eye/screen/video camera.

The observable object may comprise gratings disposed in parallel planes spaced along the optical axis, e.g. a pair of Ronchi rulings such as disclosed in EP 1324015.

The optical arrangement may comprise a record of the predetermined image and means for the demonstration of the record to a human observer simultaneously with the current image, for example a printed pattern in the field of view. The optical arrangement may comprise means for superimposing the current image on the record of the predetermined image.

In one specific example of the optical arrangement of the present invention, the optical parameter used for the identification of the change of state is the refraction index of the fluid. A portion of the fluid fills an enclosure defined between two concavo-convex lenses. On one side of the enclosure there are disposed two Ronchi rulings in parallel planes spaced along the optical axis. On the other side of the enclosure and spaced therefrom along the optical axis is a small viewer, i.e. the eye of the observer, or the screen or video camera with an aperture, or a sensor. From all diffused light beams illuminating the two Ronchi rulings,

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parallel beams are focused at a location spaced from the enclosure where the eye's pupil or the aperture are disposed. These beams form images of the rulings on the retina of the eye or a screen or image plane of the video camera, which images are in the form of a moiré pattern having a plurality of fringes. When the refraction index of the fluid is changed, the moiré pattern changes as well.

In the above specific example, the two lenses of the enclosure are selected such that the whole enclosure has optical power close to zero when filled with the fluid in the reference state, so that an infinite fringe (i.e. no moiré pattern), which is observed in that state, constitutes the predetermined reference image. When the state of the fluid changes, the refraction index changes as well and a moiré pattern distinguishable by the viewer is obtained. This is the changed image which is easy to be identified visually or by a sensor.

The method of the present invention effectively uses qualitative comparison and identification of optical images instead of quantitative assessment or measurement. The former may be done by naked eye or by sensors through quite simple, cheap and reliable optical systems. Moreover, the identification may be done by a non-qualified observer such as a user of a fluid product, following simple instructions and exemplary patterns.

Contrary to methods of measurement, the designer of the optical arrangement implementing the method of the invention has previous knowledge of the optical parameter both in the reference state and in the changed state of the fluid, so that he can design his system accordingly to make the changed state of the fluid highly distinguishable. Therefore, the arrangement may be adjusted for easy identification of a small change of the optical parameter without measuring it.

The present invention may be used for a wide variety of applications pertinent to detection of changes in the state of liquids, gases, mixtures, suspensions and like, such as production, storage, packaging and monitoring of chemicals, oil, medicines, food, drinks, water, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, specific embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic illustration of an optical arrangement for identification of changes in the state of a fluid by naked eye, in accordance with the embodiment of the present invention;

Fig. 2 is a schematic illustration of an optical arrangement for identification of changes in the state of a fluid by projecting visible patterns on a screen, in accordance with another embodiment of the present invention;

Fig. 3 is a schematic illustration of an optical arrangement for identification of changes in the state of a fluid using a prism, in accordance with still another embodiment of the present invention;

Fig. 4 is a schematic illustration of the optical arrangement of Fig. 3 enhanced by additional polarization filters; and

Fig. 5 is a schematic illustration of an optical arrangement for identification of changes in the state of a fluid using aspheric lens enclosure.

DETAILED DESCRIPTION OF THE INVENTION

With reference to Fig. 1, there is schematically shown one example of an optical arrangement 10 in accordance with the present invention. The optical arrangement comprises two gratings 14 and 16 that may be illuminated by ambient light or by a light from a diffuse light source 12 which, being optional, is shown in dotted lines. The arrangement 16 further comprises a transparent enclosure (cuvette) 18 with an axis coinciding with the direction of observation 22 via the enclosure 18 of the gratings 14 and 16, by the eye 20 of the observer.

The source 12 may be any common fluorescent or incandescent lamp. The gratings 14, 16 are common Ronchi rulings with identical period. The cuvette 18 is built of two concave-convex lenses 24, 26, whose convex faces are almost

touching. A cavity 28 formed between the lenses is adapted to be filled with a liquid to be monitored. The liquid may be any liquid whose state changes in time. The liquid's original state is considered to be a reference state, and it differs from the changed state in a known manner, i.e. these states have different known indices of refraction. The radii of curvature of the lenses' surfaces are selected so as to minimize distortion of the image while keeping the overall optical power of the cuvette filled with liquid in the reference state close to zero.

The source 12 emits light in all directions and illuminates the gratings 14 and 16 with diffuse light. The eye 20 projects images of the gratings 14, 16 on the retina 30 where a moiré pattern is formed. The pupil 32 filters the rays such that only a small portion 34 reaches the retina 30.

The cuvette 10 and the eye 20 comprise an imaging system 40 focused on the space between the gratings 14, 16. The eye adjusts its focal length such that both gratings are projected on the retina 30 simultaneously.

The size of each of the grating images on the retina is determined by the magnification of the imagining system 40, which depends on the object and image distances. The gratings 14, 16 have different positions along the optical axis 22; hence the respective magnifications are different when the cuvette 18 has non-zero optical power. The projected images thus have different periods which induce a moiré pattern (fringe), whose frequency or orientation depends on the actual magnification difference. The two gratings are rotated slightly relative to one another, and the system magnification defines the moiré fringe orientation. The liquid in its reference state, having reference refraction index, is characterized by a reference moiré pattern with predetermined frequency or orientation.

When the liquid changes its state, thereby changing the refractive index, the optical power of the cuvette 18 changes, together with the magnifications of the two gratings 14, 16. The projected images of the gratings change and produce a changed moiré pattern which has different fringe orientation from the reference moiré pattern. As will be shown below, the difference in the fringes is easily identifiable by naked eye.

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Calculations

From the laws of geometrical optics, it is easy to derive the following formula:

$$F_S = \frac{P}{d \cdot M \cdot \Delta D}$$

where F_S is the fringe shift in mm, d is the grating gap, P is the grating period, and ΔD is the optical power difference between optical powers of the lens 18 filled with fluid in reference state and lens 18 filled with the fluid in the changed state. M is the magnification of the optical system 40, which in the Fig. 1 is about 0.6 (the diameter of the projected image divided by that of the input beam, i.e. of the lens). The value of d is 2.4 mm (see below) and P is 0.025.

The optical power of the liquid lens in the cuvette is 2(n-1)/R, where n is the refraction index of the liquid and R is radius of curvature of the internal surfaces of the lenses 24 and 26. Taking R = 6 mm and Δn = 0.02 (the refraction index difference between the two states of the liquid), we find:

$$\Delta D = 2\Delta n/R = 0.0067 \text{ mm}^{-1}$$

Finally,

$$F_S = 0.025/(2.4 \times 0.6 \times 0.0067) = 2.7 \text{ mm}$$

This result may be interpreted as follows. If the cuvette 18 is adjusted to have zero optical power with the liquid in reference state, this will yield infinite fringe in the eye, i.e. no moiré pattern. When the liquid changes its state and the refraction index changes by 0.02, the projected gratings will yield moiré pattern with period 2.7 mm which should be visible.

If the gratings are so oriented that their rulings are tilted relative to each other, the changes in the state of the fluid will cause a change of the orientation of the pattern. For example, when the period of the reference fringes is 0.3 mm, a fringe shift $F_S = 2.7$ mm will induce a fringe angle of 0.3/2.7 = 0.11 rad or 6° deg. This is the approximate angle that may be distinguished by humans comparing visible pattern to a memorized pattern.

In order to have both gratings in focus on the retina, a depth of field is required that encompasses both gratings. To achieve a sufficient depth of field the iris aperture must be as small as possible, which requires strong ambient light in the room. However, the small aperture is subject to the following constraints: a) the transmitted light intensity must be sufficient to obtain good pattern visibility; b) diffraction effects from the aperture should not blur the image.

The sensitivity of the device is proportional to the magnification difference between the two states of the liquid, which in its turn depends on the spatial frequency of the grating and the distance between the two gratings. Good sensitivity requires a large gap, however, the depth of field constraint discussed above limits this parameter. Furthermore, diffraction effects limit the grating gap to a whole multiple of the so-called Talbot distance, determined by the diffraction properties of the gratings. The Talbot distance for the above example is ~ 1.2 mm and the largest gap that could be achieved before the onset of fringe blurring was 2 x 1.2 = 2.4 mm.

With reference to Fig. 2, there is shown an example of the optical arrangement of the present invention. The optical arrangement 50 differs from the one shown in Fig. 1 in that it comprises a collimating biconvex lens 52, a camera with a camera lens 54 and aperture 56, and screen 58. The other elements are similar to those in Fig. 1 and are designated with the same reference numerals.

The principle of operation is the same as that of the arrangement in Fig. 1. However, the images of the gratings 14, 16 are projected on the screen 58 instead of the retina of the eye.

The usage of two lenses with convex faces almost touching, as in the above embodiments, allows identification of turbid or highly absorptive fluids because the fluid layer between convex faces may be made very thin and transparent.

With reference to Fig. 3, a schematic optical arrangement 60 is shown, making use of a transparent prismatic enclosure (double prism) 62. The optical arrangement 60 further includes two gratings 14 and 16. The prismatic enclosure 62 has a compensating prismatic wall 68. The gratings are illuminated by ambient light

or by light from a diffuse light source 12, while their images and fringe patterns formed therefrom are observed by the eye 20.

An upper ray 70 of diffused light is deflected upwards at the prism interface. The fringe pattern in the upper half of the enclosure 62 is thus shifted in a direction perpendicular to the fringe direction. The magnitude of the shift is proportional to the deflection angle which depends on refractive index difference across the interface. A lower ray 72 deflects in the opposite direction, inducing a fringe shift in a direction opposite to the shift in the upper half of the enclosure 62. The viewer 20 observes a step (discontinuity) in the fringe pattern between the two halves of the enclosure.

Preferably, the compensation prism 68 is selected such that the step is zero when the fluid in the enclosure 62 is in the reference state, i.e. the fringe pattern will look continuous. With the fluid in changed state, having different refraction index, the viewer will observe an interruption in the middle of the fringe pattern.

With reference to Fig. 4, a schematic optical arrangement 60' is shown, which is similar to that in Fig. 3 but further includes two polarizing filters 74 and 76. The polarizers 74 and 76 are preferably mounted with perpendicular angles of polarization. They may be used with fluids which, in the changed state, change their angle of polarization, thereby allowing to identify smaller changes of the refraction index.

With reference to Fig. 5, a schematic optical arrangement 80 is shown, where aspherical lenses 84 and 86 are used to define a transparent enclosure (cuvette) 88. The light source 12 and the gratings 14, 16 are similar to the ones in the arrangements shown in Figs. 1 to 4. A collimator lens 82 focuses the image of the gratings in the eye 20 or on a screen.

The aspheric surfaces reduce spherical aberration, thus producing straight fringes. This increases the domain of straight fringes over the entire aperture of the optical system. Thereby, differences between fringe orientations in the reference state of the fluid and in the changed state appear more distinctive.

The example shows both inner and outer cuvette surfaces as aspheric but some of them may be just plane.

All embodiments of the inventive system may use ambient light instead of a lamp or other source of diffuse light. Light outside the visible spectrum may be used, such as UV or IR light. In this case, the identification may be performed by suitable sensors in cooperation with logical circuits (microprocessors), or the optical system may be equipped with a converter to visible light allowing visual identification.

CLAIMS:

1.   Method for identification of a changed state of a fluid with respect to a reference state of said fluid, the fluid having an optical parameter changing with the change of the state of the fluid, the method comprising:

        a) providing an optical arrangement including a transparent enclosure with at least a portion of said fluid, and an object observable through said optical arrangement, the arrangement being designed such that an image of said object in the changed state of the fluid (changed image) is optically distinctive from an image of said object in said reference state of the fluid (reference image) due to a change of said optical parameter, at least one of said reference image and said changed image being predetermined;

        b) illuminating said object with diffuse light;

        c) observing a current image of said object through said optical arrangement along an optical axis; and

        d) comparing said current image with said predetermined image to identify said change in state of the fluid.

2.   The method of Claim 1, wherein said reference image is predetermined.

3.   The method of Claim 1, wherein step (d) is performed by a sensor with a logical circuit.

4.   The method of Claim 1, wherein step (d) is performed by human's eye.

5.   The method of Claim 4, wherein said predetermined image is visible in said optical arrangement along with said current image.

6.   The method of Claim 1, wherein said comparing includes superimposing said predetermined image and said current image.

7.   The method of Claim 1, wherein said diffuse light is in the IR or UV spectrum.

8.   The method of Claim 7, wherein said optical arrangement further includes a converter to visible light so that step (c) can be performed in visible light.

9.   The method of Claim 1, wherein said optical parameter is refraction index of said fluid.

10.   The method of Claim 9, wherein said enclosure constitutes a lens located at the optical axis of said optical arrangement, the lens having different optical power when filled with said fluid in the reference and in the changed states.

11.   The method of Claim 10, wherein said object comprises at least two gratings disposed in parallel planes spaced along said optical axis.

12.   The method of Claim 11, wherein said gratings are a pair of Ronchi rulings.

13.   The method of Claim 11, wherein said lens has negative power, said gratings and the eye being disposed on different sides of said lens.

14.   The method of Claim 9, wherein said enclosure comprises a prism located on said optical axis.

15.   The method of Claim 14, wherein said enclosure comprises a double prism located on said optical axis.

16.   The method of Claim 9, wherein polarization angle of said fluid also changes with the change of the state of the fluid, and said optical arrangement includes two polarization filters, one at each side of said enclosure.

17.   The method of Claim 16, wherein said two polarization filters are rotated at 90° with respect to each other.

18.   An optical arrangement for identification of a changed state of a fluid with respect to a reference state of said fluid, the fluid having an optical parameter changing with the change of the state of said fluid, said arrangement comprising

        a) a transparent enclosure adapted to be filled with at least a portion of said fluid;

        b) an object observable through said enclosure;

        c) an optical system having an optical axis and enabling the observation of said object when illuminated by diffuse light, via said enclosure filled with said fluid;

the optical arrangement being designed such that an image of said object observed in the changed state of the fluid is optically distinctive from an image of said object observed in said reference state of the fluid due to a change of said optical parameter, at least one of said reference image and said changed image being predetermined, so that said identification can be performed by comparing a current image of said object to the predetermined image.

19.   The optical arrangement of Claim 18, further comprising a source of diffuse light.

20.   The optical arrangement of Claim 19, wherein said diffuse light is in the UV or IR spectrum.

21.   The optical arrangement of Claim 20, further comprising a converter to visible light.

22.   The optical arrangement of Claim 18, further comprising a sensor with a logical circuit adapted to perform said identification.

23.   The optical arrangement of Claim 18, wherein said optical parameter is the refraction index of the fluid.

24.   The optical arrangement of Claim 23, wherein said transparent enclosure, when filled with said fluid in the reference state, constitutes a lens or a prism with zero power.

25.   The optical arrangement of Claim 23, wherein said transparent enclosure, when filled with said fluid in the changed state, constitutes a lens or a prism with zero power.

26.   The optical arrangement of Claim 23, wherein said observable object comprises at least two gratings disposed in parallel planes spaced along said optical axis.

27.   The optical arrangement of Claim 26, wherein said gratings are a pair of Ronchi rulings.

28.   The optical arrangement of Claim 23, wherein said optical system is adapted to form said current image on the retina of the eye.

29.   The optical arrangement of Claim 23, further comprising a screen, said optical system being adapted to form said current image on said screen.

30.   The optical arrangement of Claim 18, further comprising a record of said predetermined image.

31.   The optical arrangement of Claim 30, wherein said record is a verbal description or a picture of said predetermined image available to a human observer before visual identification.

32.   The optical arrangement of Claim 30, further comprising means for demonstration of said record to a human observer simultaneously with said current image.

33.   The optical arrangement of Claim 30, further comprising means adapted to superimpose said record of predetermined image and said current image.

34.   The optical arrangement of Claim 23, wherein said transparent enclosure has the form of a lens or a double prism with minimal thickness at said optical axis.

35.   The optical arrangement of Claim 23, wherein polarization angle of said fluid also changes with the change of the state of the fluid, and said optical arrangement includes two polarization filters, one at each side of said enclosure.

36.   The optical arrangement of Claim 35, wherein said two polarization filters are rotated at 90° with respect to each other.

37.   The optical arrangement of Claim 23, wherein said transparent enclosure is defined at least from one side by an aspheric lens.

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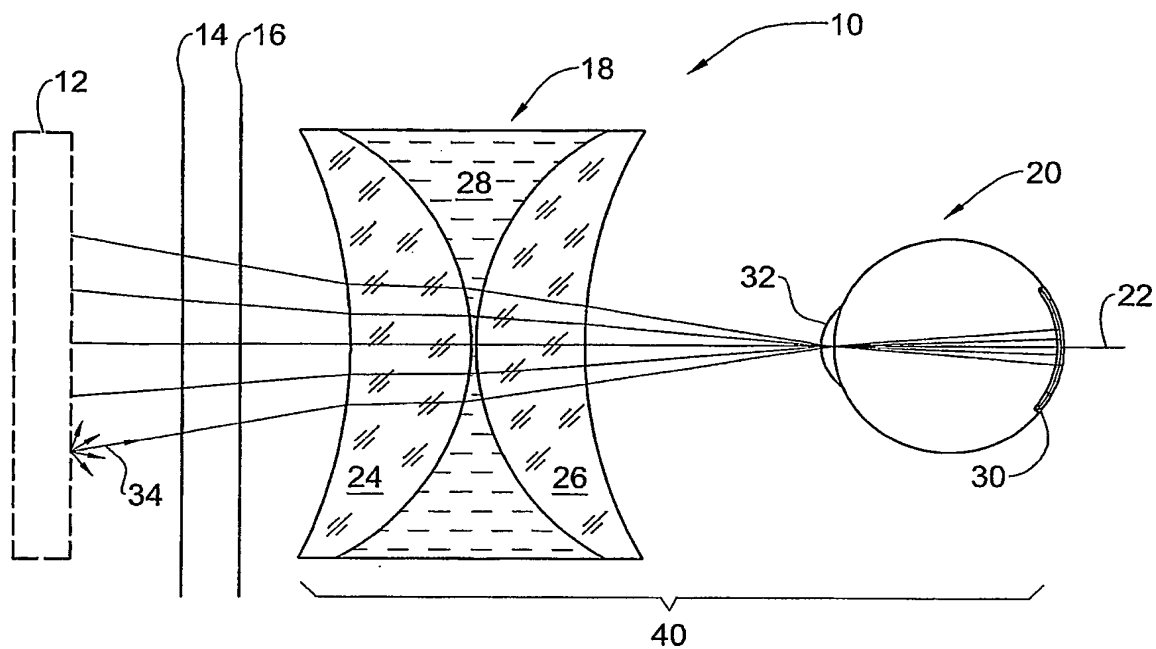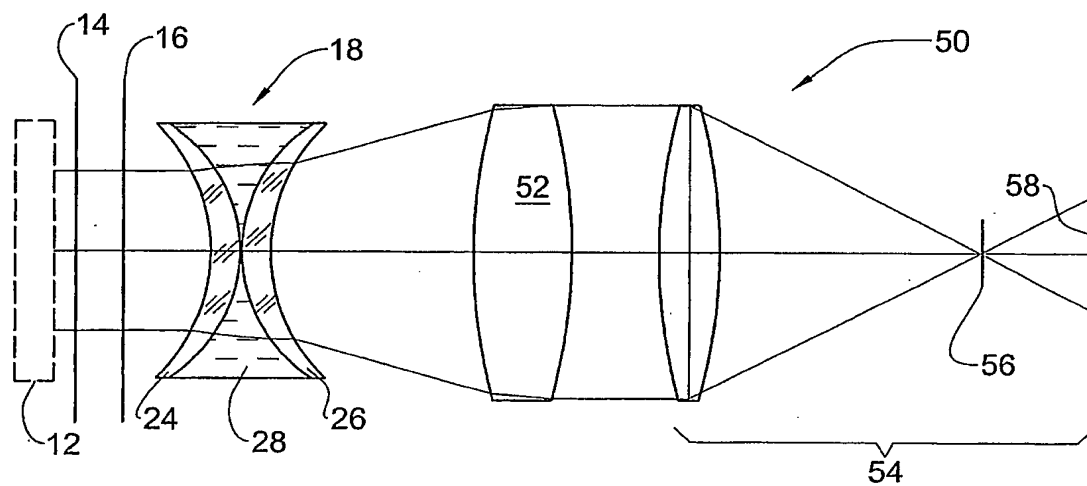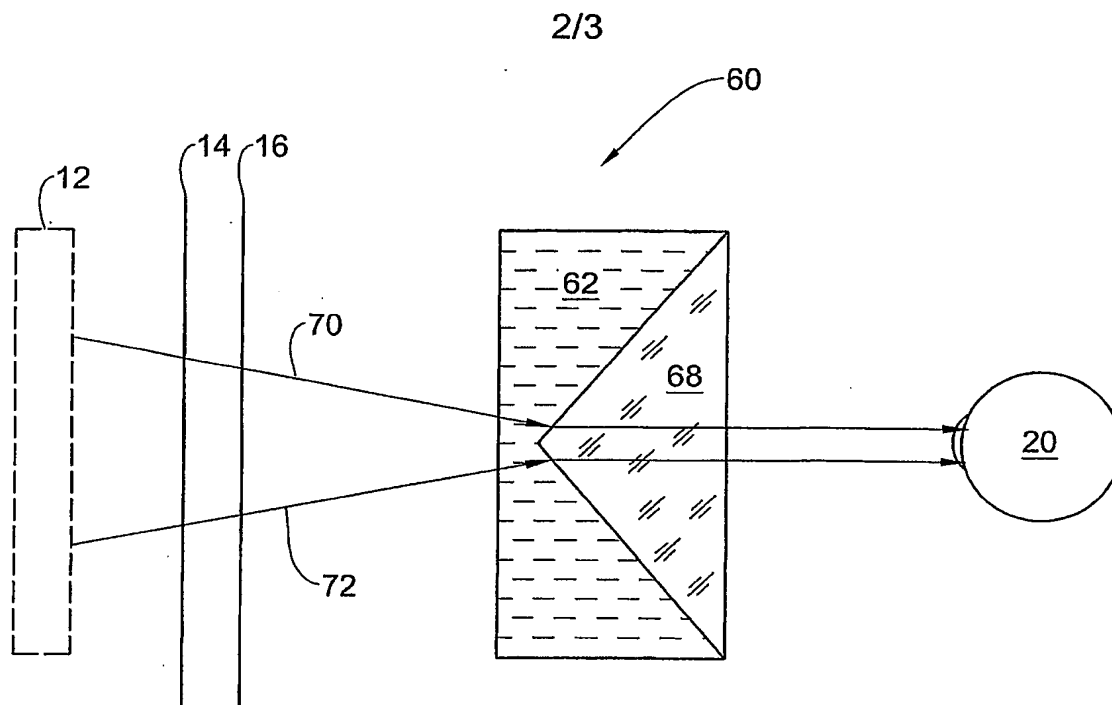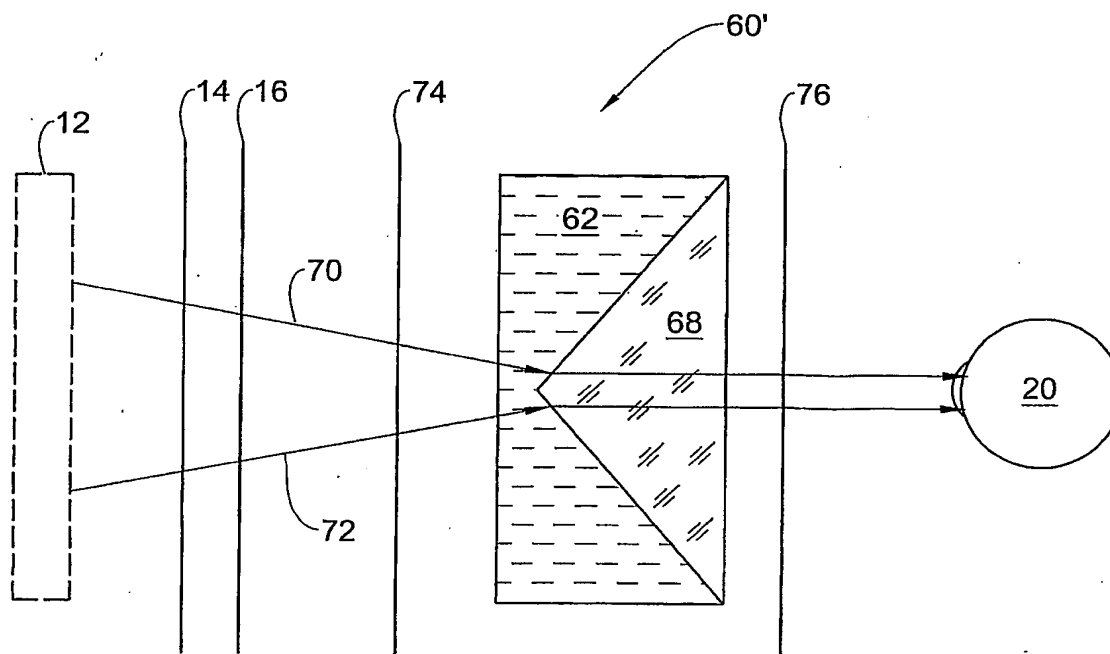
FIG. 1

FIG. 2

FIG. 3

FIG. 4
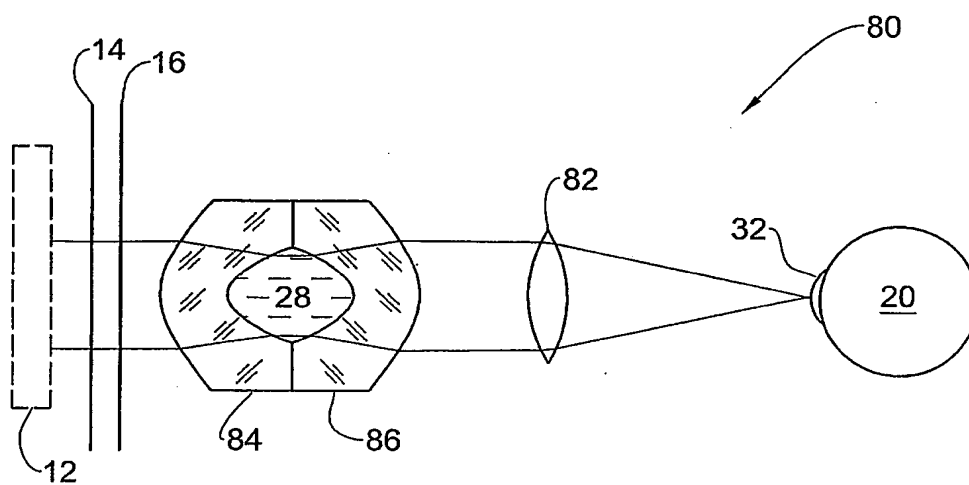
FIG. 5

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   G01N21/41   G01N21/45

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

IBM-TDB, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category°	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ANONYMOUS: "Automated Detector for Liquid Chromatography. September 1976." IBM TECHNICAL DISCLOSURE BULLETIN, vol. 19, no. 4, 1 September 1976 (1976-09-01), page 1262 XP002293729 New York, US figure 1	1-37
X	ANONYMOUS: "Nonrefractive Method of Determining Low Concentration Impurity Levels in Liquids. August 1975." IBM TECHNICAL DISCLOSURE BULLETIN, vol. 18, no. 3, 1 August 1975 (1975-08-01), pages 696-697, XP002293730 New York, US figure 1	1-37

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| X | Further documents are listed in the continuation of box C. | | X | Patent family members are listed in annex. |

° Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
25 August 2004	07/09/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Mason, W

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INTERNATIONAL SEARCH REPORT

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category°	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1 508 783 A (KODAK LTD) 26 April 1978 (1978-04-26) figure 1	1-37
A	US 4 569 590 A (KARNY ZIV ET AL) 11 February 1986 (1986-02-11) figure 1	1-37
A	EP 1 324 015 A (ROTLEX 1994 LTD) 2 July 2003 (2003-07-02) figures 3,4	1-37
A	US 4 722 605 A (KAFRI ODED ET AL) 2 February 1988 (1988-02-02) figure 5	1-37
A	MISHRA D ET AL: "Development of a coherent gradient-sensing tomographic interferometer for three-dimensional refractive index-based measurements" OPTICS COMMUNICATIONS, NORTH-HOLLAND PUBLISHING CO. AMSTERDAM, NL, vol. 212, no. 1-3, 15 October 2002 (2002-10-15), pages 17-27, XP004386874 ISSN: 0030-4018 figure 1	1-37
A	SONG J S ET AL: "Moire patterns of two different elongated circular gratings for the fine visual measurement of linear displacements" OPTICS COMMUNICATIONS, NORTH-HOLLAND PUBLISHING CO. AMSTERDAM, NL, vol. 154, no. 1-3, 15 August 1998 (1998-08-15), pages 100-108, XP004146299 ISSN: 0030-4018 figure 6	1-37

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			FR	2530802 A1	27-01-1984

Attorney Docket No.: P-9915-US

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below under my name.

I believe that I am the original and first sole inventor or an original and first joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND SYSTEM FOR IDENTIFICATION OF CHANGES IN FLUIDS

the Specification of which

☐   is attached hereto
☒   was filed on **November 24, 2003**
     as United States Application Number or PCT International
     Application No. **PCT/IL2003/000987**
     and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified Specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information known to me which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim priority under Title 35, United States Code, §119 of any provisional application filed in the United States in accordance with 35 U.S.C. §119(e), or any application for patent that has been converted to a Provisional Application within one (1) year of its filing date, or any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FILED APPLICATION(S)

APPLICATION NUMBER	COUNTRY	(DAY/MONTH/YEAR FILED)	PRIORITY CLAIMED

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application listed below, and, insofar as the subject matter of each of the claims of this application is not disclosed in any prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose

material information as defined in Title 37, Code of Federal Regulations, §1.56, which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION NO.	FILING DATE (DAY/MONTH/YEAR)	STATUS – PATENTED, PENDING, ABANDONED

Please address all correspondence regarding this application to:
[Guy Yonay]
PEARL COHEN ZEDEK LATZER, LLP
1500 BROADWAY, 12TH FLOOR
NEW YORK, NEW YORK 10036

Direct all telephone calls to (646) 878-0800 and all facsimiles to (646) 878-0801.

I hereby appoint practitioners associated with **Customer Number 49443** as my attorney(s) and agent(s) with full power of substitution and revocation to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

FULL NAME OF INVENTOR: **GAN, Livne**

FULL RESIDENCE ADDRESS: **50 Neve Zin, Medereshet Ben Gurion 84990, Israel**

COUNTRY OF CITIZENSHIP: **Israel**

FULL POST OFFICE ADDRESS: **same**

SIGNATURE OF INVENTOR _____

DATE _____
       (day / month / year)

Attorney Docket No.: P-9915-US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: GAN, Livne   Examiner: Not yet assigned

Serial No.:   Not yet assigned   Group Art Unit: Not yet assigned

Filed: Herewith

Title: METHOD AND SYSTEM FOR IDENTIFICATION OF CHANGES IN
               FLUIDS

PRELIMINARY AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Sir:

Prior to Examination, kindly amend the above-identified application as follows:

Amendments to the Specification begin on page **2** of this Amendment.

Remarks/Arguments begin on page **3** of this paper.

APPLICANT(S): GAN, Livne
SERIAL NO.:   Not yet assigned
FILED: Herewith
Page 2

AMENDMENTS TO SPECIFICATION

In the Specification:

On page 1, immediately after the Title, please insert:

--<u>CROSS-REFERENCE TO RELATED APPLICATIONS</u>

This application is a National Phase Application of PCT International Application No. PCT/IL2003/000987, entitled "Method and System for Identification of Changes in Fluids", International Filing Date November 24, 2003, published on June 2, 2005 as International Publication No. WO 2005/050179, which is incorporated herein by reference in its entirety.--
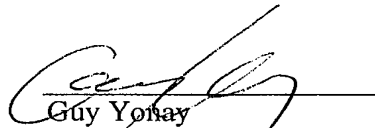
REMARKS

Applicants request entry of the Preliminary Amendment.

Applicant has amended the specification to include a cross-reference.

Should the Examiner have any question or comment as to the form, content or entry

of this Amendment, the Examiner is requested to contact the undersigned at the telephone

number below.

No fees are due, however, if any fee is due, the undersigned hereby authorizes the

United States Patent and Trademark Office to charge the fees to Deposit Account 50-3355.

Respectfully submitted,

Guy Yonay
Attorney/Agent for Applicant
Registration No. 52,388

Dated: May 24, 2007

Pearl Cohen Zedek Latzer, LLP
1500 Broadway, 12th Floor
New York, New York 10036
Tel: (646) 878-0800
Fax: (646) 878-0801